

layer. This is because it has the structure (chemistry) and function of an adhesion layer and not a polish stop layer. Specifically, Brennan teaches that the carbon content of the TiCN in his adhesion layer 28 is "deleterious" and further teaches that carbon is removed from the adhesion layer by a plasma treatment. (column 4, line 63-67 and column 5, lines 20-37) Furthermore, the adhesion layer 28 of Brennan is purposefully removed from the surface of the underlying dielectric layer 20 by a chemical-mechanical polishing process (column 6, lines 36-37), as illustrated in FIGs. 5 and 6. Thus, the adhesion layer 28 of Brennan does not function as a polish stop layer, since it is actually removed by polishing. This is possible because of the chemical difference between the low-hardness layer of Brennan and the relatively higher hardness of the layer claimed in the present claims 19 and 20 (i.e. 30 to 35 percent greater than a hardness of titanium nitride alone). The layer 28 of Brennan cannot inherently have the hardness claimed since it has a different chemistry, i.e. the carbon is purposefully removed by Brennan. Thus, Brennan fails to support the rejection of claims 19 and 20 under 35 USC 102 or 103.

Dependent claim 20 adds the further limitation that "the polish stop layer comprises titanium nitride alloyed with between 5 and 20 percent by weight carbon." Brennan describes his adhesion layer 28 as having a carbon content of about 5 atomic percent (column 5, line 39). It is known that 5 atomic percent is significantly less carbon content than 5 weight percent in this material (i.e. approximately 2 weight percent). Thus, Brennan fails to support the rejection of claim 20 under 35 USC 102 or 103.

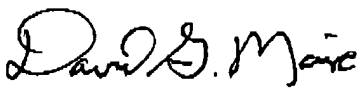
With regard to the rejection of claims 1-5 and 7 as being unpatentable over Yamashita in view of Meikle, the Examiner admits that Yamashita fails to teach the claimed TiAlN polish stop layer. The Examiner takes the position that the teaching of Meikle would make it obvious to replace the TiN of Yamashita with TiAlN. The applicants find the Examiner's position to be without support in fact. While Meikle does state that TiAlN "can replace TiN in many of its uses in semiconductor devices", Meikle only teaches that the diffusion, etching and sputtering of TiAlN is like that of TiN. Meikle does not even consider the polishing properties of these two materials. Furthermore, Meikle also teaches that some properties of the two materials are different, i.e. that TiAlN has a better thermal budget and better stability on silicon than TiN. Accordingly,

Meikle describes three similarities between these two materials and two differences between these two materials. Meikle does not suggest that TiAlN can replace TiN in all of its uses. Without some specific description of polishing properties, one skilled in the art would have no basis for drawing any conclusion from Meikle as to the relative polishing properties of these two materials. Accordingly, there is no suggestion in Meikle to replace the TiN polish stop layer of Yamashita with a TiAlN layer. Thus, Yamashita and Meikle do not support the rejection of claims 1-5 and 7 under 35 USC 103.

With regard to the rejection of claim 21 as being unpatentable over Yamashita in view of Meikle, the applicants note that the abstract of Yamashita teaches that "the TiN thin film 7 exposed at the bottom of the contact hold 9 is removed by etching." Thus, Yamashita recognizes that TiN is removed by etching and thus teaches away from using TiN as an etch stop layer. Meikle states at column 2, lines 35-36 that "TiAlN etches readily in $\text{NH}_4\text{OH}/\text{H}_2\text{O}_2$ similar to TiN." Thus, Meikle fails to recognize the significantly different etch properties of these two materials, and the combination of Yamashita and Meikle would suggest to one skilled in the art that TiAlN should not be used as an etch stop layer, thus teaching away from pending claim 21. Thus, Yamashita and Meikle do not support the rejection of claim 21 under 35 USC 103.

Reconsideration of the application and allowance of claims 1-5, 7, and 19-21 are respectfully requested.

Respectfully submitted,



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